BULLETIN OF THE
SCHOOL OF EDUCATION
INDIANA UNIVERSITY

Vol. XIV BLOOMINGTON, INDIANA No. 4

SEPTEMBER, 1938

Entered as second-class mail matter September 30, 1924, at the postoffice at Bloomington, Indiana, under the Act of August 24, 1912. Published four times a year from the University Office, Bloomington, Indiana.

Twenty-fifth Annual Conference on Educational Measurements

Held at Indiana University

April 13, 1938

Bureau of Coöperative Research, Indiana University School of Education

HENRY LESTER SMITH, Director

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The Value of the Dictaphone in Diagnosing Difficulties in Addition

MERRILL T. EATON, Assistant Professor of Education and Assistant Director of the Bureau of Coöperative Research, Indiana University

THE purpose of this study is to investigate experimentally the value of the dictaphone in discovering difficulties in addition and to test its usefulness as a method of evaluating remedial work.

Gross difficulties in addition may be easily and readily discovered by the use of standardized tests, but certain types of arithmetical deficiencies are difficult to discover and need a more thorough analysis than may be secured through the use of tests. It is not at all likely that the dictaphone or any other mechanical measuring device will supplant standardized tests in the diagnosis of difficulties in arithmetic, but it does seem desirable to find a more adequate method of studying the mental processes of those pupils who fail to show satisfactory progress in the acquisition of skill in addition.

Until recently, little attention has been given to the mental processes through which pupils pass in acquiring a knowledge of number combinations. The present trend, however, seems to be toward devising methods of psychological analysis which may be utilized by the teacher in understanding the mental processes of her pupils, thus insuring better and more progressive methods of teaching. To learn whether or not the dictaphone may be used as an accurate and reliable instrument for the study of the mental processes of pupils and whether or not it may be used as a satisfactory device for the diagnosis of difficulties in addition is thus more significant in this investigation than the actual diagnosis.

If the dictaphone is an accurate and reliable instrument for studying mental processes, then it should be more widely used in diagnostic studies. The dictaphone, however, has been used in relatively few diagnostic studies. In typewriting, Pearson (4) used dictaphone records run at graduated rates of speed. Records were operated at various speeds to meet the individual needs of the pupils. Pearson concluded that in the teaching of typewriting the dictaphone method is superior to the traditional method. A number of teachers of typewriting who have used dictaphone records as an aid in developing speed and accuracy have indicated that they are helpful. According to Tedens (7) the dictaphone method was adopted by the teachers of typewriting in the Chicago high schools in 1928.

Buswell (1) refers to studies in which the reading and speech of pupils were recorded on dictaphone records. A number of interesting studies were made of the rhythm of reading and the speaking of pupils of various levels of maturity. Permanent records of speech were secured on dictaphone cylinders, and these later were subjected to pre-

cise time analysis by translating the rhythm to records on a kymograph. Dictaphone records of oral compositions of pupils of upper grade and high school levels have furnished excellent bases not only for analyzing the rhythm of speaking, but also for criticizing various types of vocal behavior.

Roszmann (5) found the machine valuable in recording the responses of children in intelligence testing, and Greenleaf (2) and Kunze (3) used it in foreign language classes. As early as 1915, Taylor (6) pointed out the value of the dictaphone in language, commercial studies, speech, and arithmetic, and in spelling drills. In spite of the advantages claimed, teachers seem to have made comparatively little use of the dictaphone in the schools, and its value in diagnosing difficulties has been almost entirely neglected.

EXPERIMENTAL CONDITIONS

In the present study the experimental conditions were as follows:

Apparatus.—The dictaphone used was a standard instrument manufactured by the Dictaphone Corporation of New York, type A, model 10-X. No modifications or changes were made in the dictaphone except that a Y-type sleeve was constructed so that two mouthpieces could be attached to the dictating machine. The dual control was necessary so that the exact time between the giving of the combinations to one of the subjects and his subsequent responses could be accurately determined.

Subjects.—Five subjects were chosen at random from the elementary schools of Bloomington and vicinity. The children, three boys and two girls, are representative of the typical school population. A brief case history of each of the subjects follows:

Subject A: Boy nine years old, in the fifth grade, whose father is a stone mechanic with good income. He has an intelligent mother and one brother, fifteen years old and in high school. He has a good background and a fine attitude; is a thorough worker with a high I.Q.; his greatest difficulty lies in oral English. His hobby is collecting, especially stamps. His teacher reports that he displays unusual skill in simple addition, but encounters difficulty with problems involving "carrying" and large sums.

Subject B: Boy nine years old, in the fifth grade, whose father is a carpenter. He has three brothers and one sister—one brother is married; two brothers are in high school, one a sophomore and one a junior; and his sister is a senior in Indiana University. He attends regularly an ungraded rural school. His teacher reports that he has great difficulty in "carrying" and that he is hesitant and inaccurate with certain number combinations.

Subject C: Boy eleven years old, in the fifth grade, whose father operates a derrick at a stone quarry. The family income is more than sufficient to meet their needs, but the mother is a poor manager, uneconomical and wasteful with the father's income. He has two brothers and three sisters—one brother is married and employed in a stone quarry; one brother is younger; and the three sisters are older, two

being married and one employed in an office in town. The subject has a poor background and is nervous and flighty. His teacher reports that he does not try to learn number combinations, is inaccurate in "carrying," and is inattentive.

Subject D: Girl fourteen years old, in the eighth grade, whose father is a laborer in a furniture factory. The father's income is not sufficient to meet the family needs and the mother sews to add to the family income. The subject has one younger sister. She is large and overweight for her age. Her teacher reports that although she is *slow* in all of her subjects, her most serious difficulties are in arithmetic, especially in addition.

Subject E: Girl seven years old, in the first grade, whose parents are divorced. Her mother is employed as a cook in a restaurant. The subject is small, underweight, timid, and retarded in all her school work. She receives little help or encouragement from her mother. Her teacher reports that she seems unable to learn the simple number combinations.

Materials.—For Subjects A, B, C, and D the test problems were uniform. The initial test consisted of a series of simple addition problems of one and two columns, six and eight digits high. Similar materials were used for the final test. Drill problems were constructed to meet the individual needs of the subject.

For Subject E, the seven-year-old girl, the initial test, final test, and drill materials were adapted to her age and ability. At first flash cards were used, with emphasis on combinations from 0 to 9. Later she was tested with pencil and paper on two-digit combinations.

All testing and drill work were conducted in a quiet room where distractions were held to a minimum. Only the experimenter and one subject were in the laboratory during a testing or drill series. Instructions were the same for each subject.

Procedure.—On the first day that the subject reported, he was given a series of problems to add with pencil and paper and he was instructed to speak his thoughts aloud. Pencil and paper addition was continued until each subject added aloud without hesitation. Following the pencil and paper addition, each subject was instructed in the use of the dictaphone and was drilled in speaking into the mouthpiece. Preliminary recording was continued for each subject until he spoke clearly and without hesitation. No difficulties were experienced in training the pupils to think aloud or to speak clearly and distinctly into the mouthpiece of the dictaphone.

Following the preliminary training, the initial tests in addition were given. The subject began each recording by dictating his name and the type of problems he was adding that day. Testing and drill periods were limited to approximately ten minutes each day. The entire experiment was distributed over a period of five weeks.

The initial tests of Subjects A, B, C, and D were studied carefully by the experimenter. The records were run and rerun until all errors had been discovered and marked. Each subject then listened to his own records and attempted to discover his errors. Errors which the subject did not discover were pointed out by the experimenter. After the sub-

ject was familiar with the number and kind of errors he had made, ways and means of correcting these were discussed. Remedial materials were prepared and adapted to each subject's individual needs, and the subject was drilled on these materials until the errors shown in the initial tests seemed to have been corrected. A final test consisting of problems similar to those of the initial test was given for the purpose of providing an objective measurement of the value of the remedial drill work.

The preliminary work with Subject E revealed that she was very weak in simple number combinations. Because of this and her age, more detailed and simplified drill materials were necessary. Pencil and paper addition of simple two-digit combinations was used along with flash cards. Subject E seemed uncertain about all combinations unless the experimenter pronounced them orally. The two speaking tubes were especially valuable in her case. The experimenter could present the flash card and at the same time pronounce the number. The exact time between the pronouncing of the numbers and the subject's response could be accurately determined.

RESULTS

More than 75 records were completed. The number made by each subject varied somewhat because of individual differences in speed of addition. The complete records for each subject were analyzed and compared. A summary of the diagnosis for each subject is given below:

Initial tests.—Subject A, whose ranking in intelligence is superior to those of the other subjects, encountered less difficulties in addition than the other four. Progressing with accuracy and speed, he added regularly digit to digit up the columns and gave only the sums. On the average, he completed two six-digit columns every nine seconds. Quick to see most of his errors, he would attempt to correct himself. For example, "17, 23, 31. No, I got that wrong; 17, 23, 32," etc. At such times he did not puzzle over his numbers, but moved on with even speed. He had three chief difficulties. While he was fairly accurate with simple problems, he experienced difficulty in carrying, especially when the sums were large. His speed was retarded on combinations involving 8 and 9; and he had particular trouble with $7 + 4$, $8 + 3$, and $9 + 5$.

Subject B had more difficulty with carrying than did Subject A. He worked simple number combinations easily, adding digit to digit up the columns. Occasionally he repeated the numbers to be added, but he averaged two six-digit columns in ten seconds. Hesitating frequently in his addition, he seemed less confident of himself than Subject A and often changed the last sum. For example, "9, 16, 22, 27. No, 26. 8, 14, 17, 25, 34. No, 33." All combinations involving 9 caused special difficulty.

Subject C was both slow and inaccurate. He spent more than seven minutes in adding those problems which Subjects A, B, and D finished in three minutes. Finding it hard to give his attention to his work, he repeated most of the numbers and performed motor activities as aids. He skipped about in order to find combinations which were familiar to him, and, as a result, he often omitted numbers. It appeared that no

particular combinations caused him special difficulty, but that any combination might be passed over with but a mere guess at the sum.

Subject D added slowly and with much hesitation. She added up the columns digit by digit and made no attempt to find familiar combinations. She displayed accuracy in simple combinations, but in those involving 9 or large sums she was hesitant and inaccurate. Her performance was comparable to that of Subject C.

Subject E was very weak and hesitant on all number combinations. On the most simple two-digit combinations, such as 2 + 1, 2 + 2, etc., she progressed at a fairly rapid rate if the numbers were pronounced by the experimenter, but on the larger combinations she became hesitant. She frequently paused as long as 18 seconds and a few times as long as one minute in responding to a two-digit combination. She indulged in motor activities, such as tapping her toes and twisting and squirming in her chair.

Final tests.—A comparison of the initial and final tests of each subject revealed improvement, although of varying degrees. Each subject was at a different level of development in arithmetic; and, while drill was given individually, the outcomes were different. Some general statements of comparison, however, may be made.

Improvement was made in both speed and accuracy. All subjects made gains in speed, especially Subjects A, B, and D. The gains in speed for Subjects C and E, however, were slight. Even though Subject E was given more individual attention and more varied practice materials than the other subjects, she still needed far more than it was possible for the experimenter to give.

In accuracy the gain was appreciable for all subjects. Drill reduced errors especially on combinations involving 8 and 9, and on those involving carrying. The children were much less hesitant in their responses and were able to find and correct their errors more quickly.

SUMMARY AND CONCLUSIONS

In order to determine whether or not the dictaphone is of value in diagnosing difficulties in addition, five subjects, three boys and two girls from ages 7 to 14, were given a series of addition problems. As a means of discovering difficulties, an initial test of one- and two-column problems, six to eight digits high, was given. As remedial measures, a wide variety of practice problems was presented. Following this drill, a final test was given, containing problems similar to the initial test, as an objective measure of the remedial work. Experimental conditions were the same for each of the five children. No instructions were given concerning speed and accuracy. As each child added aloud, his words were recorded on dictaphone records. Practice materials for Subject E differed from those for the other subjects in that flash cards were used in addition to pencil and paper addition. The records of each subject's performance were analyzed, initial and final tests were compared, and remedial drill work was evaluated. The results of this study indicate that the outstanding values of the dictaphone in diagnosing difficulties in addition are:

1. An objective, verbatim account of the mental processes of the subjects is provided.
2. An accurate account is provided.
3. Speed of addition may be accurately determined.
4. Specific difficulties may be easily discovered.
5. Remedial drill work may be immediately evaluated.
6. A means of making the subject conscious of his deficiencies is furnished.
7. An exact means of measuring improvement is provided.
8. Drill work is definitely motivated by recording.
9. A means of keeping a record of satisfactory remedial drill materials is provided.
10. Individual diagnosis by use of the dictaphone is rapid and inexpensive.

Since a child's attack on addition problems, his comments while adding, and the accuracy of his combinations are exactly recorded, the dictaphone can be used effectively in diagnosing difficulties in addition. Older pupils may supervise the making of records and the teacher may, at her convenience, study these records as intensively as is necessary and plan and apply remedial measures more carefully and accurately. The dictaphone was also found to be of great value in remedial work. The children recognize their errors as the records are run and concentrate on these difficulties in the drill exercises.

In the diagnosis of difficulties as well as in remedial work a teacher would be enabled by means of the dictaphone to have a complete picture of a child's mental processes instead of isolated facts. Thus she would be better equipped to meet the individual needs of her pupils.

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The Measurement Program in a City School System

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THE scientific measurement of school results has developed in the last three decades. In 1908 the Stone Reasoning Tests in Arithmetic appeared. In 1910 the Thorndike Handwriting Scale appeared, followed in 1912 by the Ayres Handwriting Scale, and in 1914 by the Freeman Handwriting Scale. In 1912 the Hillegas Scale for Measuring English Composition appeared. About this same time tests were devised in the fundamental operations in arithmetic. Dr. Stuart A. Courtis led in the development of arithmetic tests.

When your speaker organized the Bureau of Research in the Kansas City public schools in 1914, twenty-four years ago, there were only three or four other such bureaus in the United States. There were but few standardized scales or tests for measuring school products. From 1914 to 1930, achievement tests appeared in large numbers—some most excellent and well standardized; many almost valueless. Also many bureaus of research were established during the same period. The American Association of Educational Research was organized at Cincinnati in 1915.

The smaller school systems that could not establish bureaus of research introduced a testing program under the direction of some principal, supervisor, or superintendent of schools, so that programs of tests and measurements in public schools became almost universal by 1930.

The past three decades have seen the development, not only of achievement tests, but also of intelligence tests. In the latter part of the nineteenth century, various attempts were made to measure mental ability. In 1905, Binet published his first series of thirty tests of intelligence. These tests were extended in 1908. By 1910 Goddard, in America, was using these tests extensively. In 1912, Stern suggested the title "intelligence quotient or I.Q." In 1916, Terman published a revision of the Binet tests. This scale has been the most successful of all scales for measuring intelligence and mental ability. A few years ago Dr. Terman made a revision of the 1916 scale. This revision was placed on the market in 1937 and is proving very satisfactory, indeed, as it has removed many of the weaknesses in the 1916 scale.

In the early days of scientific tests and measurements, the value of test results was greatly overestimated. The success of teaching was estimated by test scores. The quality of work in a school building was judged by test scores. Even the standing of entire school systems was judged by test results. In many cases test results brought to teachers and school systems praise or blame not always merited. Such judgments

were based on insufficient data, because only the more mechanical, formal subject-matter could be tested accurately. Too much emphasis was placed upon skills and factual material. Also, the score itself was given too much emphasis, and not enough attention was given to the growth of pupils even in the skills and knowledges that were being tested. Furthermore, tests had not been devised for measuring attitudes of pupils or power of appreciation. Many attempts have been made and are being made to develop tests of attitudes and of appreciations in pupils. Much progress has been made in this direction, but there are still no such tests that can be recommended for general use, so, in the field of measurement, we are still confined to tests that measure: (1) knowledges or facts; (2) skills; (3) general intelligence and mental alertness (rate of learning); (4) power of judgment or discrimination —to a limited extent; (5) mechanical ability and other special abilities such as music and art—to a limited degree only.

Leaving the story of the historical development of tests and the general background of the movement, it is interesting to note at this point some of the results of this scientific testing movement. The scientific movement has made almost revolutionary changes in school practices. To realize this one needs only to compare school procedures today with school procedures prior to 1900. Some of the major changes that can be noted are: (1) A distinction has been made between oral and silent reading. Before the time of scientific measurement almost the entire emphasis in teaching reading in the public schools was on oral reading. The testing movement brought out the value of silent reading and shifted the emphasis in teaching. In some instances it brought an extreme emphasis upon silent reading to the neglect of oral reading and correct speech. (2) Testing has revealed the difficulties of various items of learning and enabled these items to be graded for instructional purposes more accurately than heretofore. Thus, the testing movement has resulted in a remarkable improvement in grade placement of materials in the various subjects. (3) In arithmetic, scientific tests show conclusively that abilities in problem solving do not automatically come from the development of facilities in addition, subtraction, multiplication, and division, but that problem solving must be taught as an independent part of the arithmetical instruction.

While the more striking improvements in methods and procedures have been made in the formal tool subjects, the content subjects also have been greatly modified as a result of testing. The scientific method has enabled us to evaluate methods of teaching by checking the results obtained by this method; to evaluate the equipment; to study scientifically the size of classes; to evaluate laboratory methods; to check the value of visual education, etc.

Probably one of the most important influences of the scientific movement in education has been its effect upon the attitude of the teacher herself. Many teachers are today unconscious of the change that they have made in their methods of attack. They have ceased to look upon themselves as the mere dispensers of knowledge and have come more and more to regard their work as that of guides and advisers of pupils

in the learning process. They have become interested in the learnings of their pupils rather than in mere acquisition of facts and skills.

When a testing program becomes an integral part of the work of a modern city school system, its purpose must be to improve the quality of service for the children, to help the teacher in securing from the children optimum growth and optimum learning. Many of you may have good testing programs in your schools. No one knows the best testing program, but the program as set up in Kansas City may be of interest. This program falls under three main heads:

1. Achievement tests in subject-matter. These tests consist of two classes—survey tests and diagnostic tests.
2. Intelligence tests. These are of two types—group intelligence tests and individual intelligence tests.
3. Miscellaneous and special tests. These will be described more in detail later.

The testing program in the public schools of Kansas City is a continuous one from the opening of school in September until the close of school in June. It has three principal testing periods:

1. A large amount of testing is carried on at the opening of school. These tests are for two purposes:
   a. Tests given for classification of pupils who have moved from other school systems into the Kansas City school system, or whose grade placement is in doubt.
   b. Diagnostic tests to determine the strength and weakness of individual pupils in order that the teacher may plan a more valuable instructional program.
2. The second testing period comes at the end of the first semester and the beginning of the second semester. Some of these are resurveys needed to determine in general what has been accomplished during the first semester of the year. However, the greater number of these tests are diagnostic in nature and are intended, as is the case with all diagnostic tests, to determine the strength and the weakness of individual pupils in order that the teacher may build a more helpful instructional program for the second semester.
3. The final and spring testing program is for the purpose of checking results in rooms and buildings, and sometimes in the system as a whole. The results of these tests enable classroom teachers, principals and supervisors, and directors to know more accurately the success of the methods and procedures that they have been following during the year.

The testing program in Kansas City has great flexibility. In the fall program there are few required tests, sometimes none. This leaves each building free to select the tests which the principals and teachers feel will be most helpful to them in diagnosing the needs of the pupils.

Our policy is to use enough survey tests from time to time to enable us to have a good picture of the achievement results in the various schools and in the school system as a whole, also to encourage principals

and teachers to use diagnostic tests as needed in the improvement of the instruction in their classrooms and buildings. For example, one building may find it advisable this year to make a special study of arithmetic in order to improve the work in that subject. Another building may desire to make a study of reading; another of language. The buildings are allowed a degree of freedom in the subjects they emphasize for any particular year. Sometimes it is desirable to make a special study of one subject throughout the system. Then the teachers in all buildings are asked to coöperate in such a study. By means of the use of survey tests we are enabled to check our achievement results in any given year with those in preceding years. For example, in 1937 we used exactly the same survey test in spelling that we used in 1924. In this way we determined the general standing of our spelling in the two years. It is rather interesting to us to note that in our seventh grade classes in 1937 the pupils spelled better on the average than in 1924; however, in the grades below the seventh grade the pupils averaged slightly better in 1924 than in 1937. The difference was not great enough to be significant.

By checking our handwriting at intervals of three or four years by means of the Kansas City Handwriting Scale we are able to determine whether or not we are making improvement in the quality of handwriting.

At the present time very satisfactory tests, both standardized and local, can be had in spelling, arithmetic, and handwriting. Tests in reading and language for the upper grades are quite satisfactory. It is rather difficult to find tests that are satisfactory in lower grade reading. There are so many factors in reading that no one test covers all of the desirable factors. Among the most important things to be tested in this field are vocabulary, paragraph meaning, and rate of reading. Rate of reading and ability to judge paragraph meaning vary greatly with the type of reading material. Informational material is much more difficult to read than simple narrative.

We are lacking satisfactory tests in the social studies. We have been attempting to make some tests, but we do not feel that they are satisfactory, although they may be suggestive. These Kansas City tests have been made coöperatively by groups of teachers. There is some advantage in making them in this way, since the making of tests is an important learning process for teachers. We feel that a continuous testing program is of very great value in a city school system in improving the quality of teaching. The scores made by individual pupils and by rooms in schools are freely given to pupils, parents, and teachers.

In Kansas City we have a seven-grade elementary school system. Large numbers of pupils come to us from eight-grade systems. The problem of classification of these pupils is a rather difficult one, since it usually means that a pupil who comes to us in the seventh grade from an eight-grade system must take the sixth grade in our system. In order to settle these problems of classification we have had to resort to standardized test procedures. For this purpose we use either the Stanford Achievement Tests or the Metropolitan Achievement Tests. Our Bureau of Research tests several scores of children each year and classi-

fies them according to the results obtained by means of these tests. Both of these tests are entirely satisfactory and both are about equally accurate. The Metropolitan Achievement Test is slightly more diagnostic and is often used for that reason. Principals also are granted the privilege of using either the Stanford or Metropolitan Achievement Tests for the purpose of testing in their own schools. Many principals employ these tests as a means of improving the classification of their schools since the results are very dependable.

In the field of mental testing we feel that the intelligence test results should be treated confidentially and should be used only by principals and teachers in the matter of guidance and classification of pupils. Our testing program in intelligence tests is as follows:

1. The Terman Intelligence Test, Second Revision, is used in testing every pupil in the kindergarten and the first four grades. These tests are made by our psychologist assisted by about twenty half-time teachers.
2. Every fourth grade pupil is given the Henmon-Nelson Intelligence Tests.
3. Every sixth grade pupil is given the Henmon-Nelson Intelligence Tests.
4. Every freshman pupil in high school is given the Terman Intelligence Test.
5. Every senior in high school is given the Ohio Intelligence Test.

The results of these tests are used for classification and guidance of pupils. They are confidential and are not given to the pupils themselves, nor to their parents. They are used only by teachers and principals.

As in the case of achievement tests, the value of an I.Q. some twenty years ago was very greatly overestimated. Most teachers now recognize an I.Q. as only one factor in guiding pupils and only one factor in determining classification. It is probably unfortunate that this quotient is known as an "intelligence quotient," since it is more a measure of mental alertness or a measure of the rate at which a pupil learns certain academic material than it is a measure of general intelligence. If it is a measure of intelligence, it is a measure of intelligence only with regard to the abstract academic material that is ordinarily given in the academic course in elementary schools and in high schools. It certainly is not a measure of social intelligence. It is not a measure of intelligence in relation to mechanics, and it does not in any way measure special ability in such subjects as music and art. We feel, however, that the I.Q. is very valuable in enabling principals and teachers to know the rate at which pupils will be able to master ordinary, academic school material.

In the case of achievement tests, the pupil by his efforts may improve his results. Therefore, it is proper that each pupil and his parents should know his achievements in subject-matter. However, in the case of intelligence test results, the pupil cannot change his I.Q. by effort on his part. Our experience in Kansas City has been that it is very unwise to furnish either to pupils or to parents the I.Q.'s or intelligence scores

of individual pupils. It is impossible to educate the parents or the pupils so that they will evaluate properly these scores. Therefore, the I.Q.'s or intelligence scores are treated confidentially and are used only by our teachers and principals for guidance purposes.

Pupils who are admitted to any of the special schools, such as the sight-saving class, School for Crippled Children, Special School for the Deaf, open air rooms, opportunity schools, and ungraded rooms, receive special tests. For example, crippled children are admitted only on recommendation of orthopedic physicians, but before admission they are sent to our psychologist, who gives them a mental test. We do not admit to the School for Crippled Children pupils who are below 70 I.Q., since we feel that such cases are institutional rather than public school cases. In our opportunity schools we do not admit pupils below 50 I.Q. since, in general, pupils who test below 50 I.Q. are institutional cases rather than cases to be educated in public schools.

For the guidance and help of teachers, all pupils in the school system from the third grade through the seventh grade are given audiometer tests for hearing. A very small number of pupils are so defective in hearing that they need to be in the Special School for the Deaf. However, many pupils are only slightly defective in hearing. The knowledge of this fact enables the teacher to serve the pupils better.

The eyes of all pupils are tested by the Snellen Chart.

The school system maintains a full-time psychologist but does not have a psychiatrist. Special problem cases that involve extreme behavior problems are referred to the community psychiatrist. Pupils who become special problems in their progress through school are very carefully analyzed by means of various tests, both physical and mental. If their lack of progress is due to low mentality, they are transferred to opportunity schools or ungraded rooms. If their slow progress is due to some physical defect which can be remedied, they are referred to the proper sources for medical treatment. Inability to read and poverty of vocabulary we find to be a leading cause of retardation. Pupils who are having serious reading difficulty are sent to the psychologist, where they receive a thorough mental examination and a complete series of reading tests.

Within the last year we have introduced in the Psychological Clinic the Ophthalm-O-Graph which measures the eye movements of children. This has enabled us to give further helpful service to a number of children.

In fact we have found it desirable to organize a special group for the improvement of reading. We are maintaining at one of the elementary schools two rooms which we designate as the "reading clinic." One room handles the primary grades, grades one to three, and the other room cares for the upper grades, grades four to seven. Pupils are admitted to these rooms only on recommendation of the psychologist and on account of reading deficiency. We have in each room a skillful teacher of reading. By the skill of the teacher and the use of the metronoscope we have been able to render invaluable service to a large number of pupils. The pupils are kept in the reading clinic only as long as is necessary. They may be there for two or three months, five or six months, or in some cases a year. Most of the pupils make remarkable progress when their chief attention is centered upon reading only.

Some pupils have gone from third-grade level to fifth-grade level in reading in three months.

After the World War our attention was centered upon the physical education of children. Much attention was given to height and weight charts. As in other new things, there was considerable overemphasis on the value of height and weight charts. The children in the public schools of Kansas City now have their height and weight taken twice each year. We are now interested, not so much in the height and weight of a child, as we are in the growth in height and in weight which the pupil makes during the year. That is, physical education means normal growth, just as academic education means normal growth in the academic subject-matter and skills.

The system is also interested in the removal of physical defects. Therefore, our nurses and physical education teachers make a careful check of every child in order to determine all physical defects and make notes relative thereto. The attention of the parents is called to these defects and they are asked to consult their family physicians. The system does not provide medical service for school children. However, children in indigent families are referred to the free clinics of the city. Kansas City has a very large number of free clinics so that there is little difficulty in securing free treatment for those children whose families are unable to provide proper medical service.

As a stimulation for the correction of physical defects, the Kansas City school system has for several years used in the kindergarten and the first four grades the Nine-Point Button System. By this system each child in the kindergarten and the first four grades receives a button on May Health Day, provided he has met the nine points required. The nine points required include the following: (1) birth certificate filed with the school; (2) immunization against diphtheria; (3) vaccination against smallpox; (4) healthy tonsils or tonsils removed, and nose free from adenoids; (5) reasonably perfect hearing; (6) reasonably perfect vision, or vision defects corrected by eye glasses; (7) teeth free from cavities, or cavities filled properly; (8) reasonably good posture; (9) normal or near normal growth in height and weight during the year.

This scheme has been in operation since the year 1926-27. It has had a marvelous influence in securing the correction of physical defects and in securing immunization against diphtheria and vaccination against smallpox. At the present time 91.0 per cent of the elementary school children are immunized against diphtheria and 88.6 per cent are vaccinated against smallpox. The percentages of children in kindergarten and the first four grades receiving Nine-Point Buttons, that is, meeting each of the nine points required, since the plan has been instituted are as follows:

1927	14.9 per cent	1933	65.1 per cent
1928	38.0 per cent	1934	68.3 per cent
1929	49.0 per cent	1935	70.3 per cent
1930	58.0 per cent	1936	72.7 per cent
1931	58.6 per cent	1937	73.3 per cent
1932	60.4 per cent		

SUMMARY

The testing program of the Kansas City public schools consists of an extensive use of achievement tests, both survey and diagnostic. These tests are used at the request of the central office or at the option of the principal and teachers. The use of these tests has proved an invaluable means of improving instruction and has almost revolutionized the attitude of teachers and their teaching processes.

While the nationally standardized commercial tests are used in the major part of the testing program in Kansas City, a large number of tests are constructed locally. The construction of local tests, based upon the local course of study, is extremely valuable to teachers in the promotion of growth of teachers in service.

Kansas City also has given individual intelligence tests to all pupils in the kindergarten and first four grades, and to all pupils that are problems of any kind in grades above the fourth.

Group intelligence tests for guidance in the classification of pupils are used in the fourth grade, sixth grade, freshman year of high school and senior year of high school.

Achievement test scores are reported to parents and pupils. Intelligence test scores, both group and individual, are kept confidential for use of principals and teachers in classification and guidance of pupils.

An extensive miscellaneous testing program is conducted for the classification of atypical children, and for the study of problem children.

The Nature of and Factors in Ability in the Light of Recent Evidence

FRANK N. FREEMAN, Professor of Educational Psychology, University of Chicago

SOME practical questions which should be answered concerning the nature of and factors in ability are as follows: Can ability be created or developed by education? Are abilities within the individual uniform or are they specialized? Should educational guidance concentrate on the abilities in which the individual is superior or should it be directed toward development of abilities which the individual needs in order to meet external demands? What is the relative importance of intelligence and of special or group abilities in meeting vocational and other practical demands? And finally, what is the relation of intellectual abilities to personality and character in the factors in achievement?

In answering these questions it is necessary to secure information concerning the nature of abilities. The pertinent questions concerning the nature of abilities concern their descriptive character, their organic basis, and their source—whether they are native or acquired.

Various theories have been held concerning the nature of abilities. The first and earliest theory is that of faculties. According to the faculty theory, there are some faculties which are general, like memory and imagination; some are more specific, like language and number; and some are nonintellectual, like caution and humor. This theory holds that each faculty has its seat in a particular area of the brain and depends upon the size or complexity of the structure of that area. It is not clear whether it holds that abilities are native or that they are acquired.

Another theory is represented in the common-sense idea of aptitudes. According to this concept, abilities correspond to practical activities, such as those which are involved in the school subjects or in the pursuit of the various vocations. This view does not set up any hypothesis as to the organic basis of aptitudes; it probably implies that they are native. It sometimes includes the notion that there is a negative correlation or compensation between aptitudes.

The remaining theories are advanced by technical students in psychology. The first of these is the theory of special factors. According to this theory, abilities consist of narrow, specific elements in behavior. These elements may be so narrow as to consist of response units. The organic basis of such factors is not always clearly set forth but probably consists of neural response elements. Some who hold this theory believe that abilities are inherited according to Mendelian Law; others believe that they are acquired through activity and learning.

The second technical view is the two-factor or bi-factor theory in its modern form, including group factors. According to this view, ability

consists, in part, of one general factor or *g;* of many narrow, special, and independent factors which are called *s;* and of a limited number of group factors of wider scope than the *s* but narrower scope than the *g*. Spearman has advanced the view that the *s*'s depend upon brain mechanism and the *g*'s upon the total store of energy. Abilities, according to this view, may be either inherited or acquired, but it is considered more likely that they are inherited.

Finally, we have the theory of primary abilities which are similar to the group factors in Spearman's theory. The organic basis of these abilities is not specified, and it is not specified whether they are native or acquired.

In seeking for evidence of the theory of abilities we may first consider the question as to whether they are inherited or acquired. This question is primarily conceived in relative terms, i. e., the question is whether the differences existing between persons are hereditary or the result of environment and experience. There is abundant evidence that differences are influenced to a considerable degree by the environment. The question may be raised as to whether this means that the environment modifies the structure of the brain or other parts of the body or whether it merely modifies function. This leads to the further question as to whether so-called traits are dependent upon structure or whether they are functions which may vary within the same structure. The difference between the proponents of the theory of heredity and that of environment may be due to the fact that the hereditarians believe that the basis of abilities is structure and that the behaviorists believe that it is function. It may be that both structure and function are responsible for individual differences and that both are modifiable by experience. However, it seems likely that abilities which are chiefly functional in character will be more easily modified than those which depend chiefly upon structure. For example, sensory keenness may depend chiefly on the structure of the sense organs. The ability to solve a given type of problem, on the other hand, may be due to the development of the function of reasoning in respect to a particular subject. This, of course, is only hypothetical.

Some evidence is at hand concerning the correlation of abilities. The abilities of a given individual are not equal. There is, on the contrary, a considerable diversity. Between some groups of abilities the correlation is so low as to approach zero.

This diversity in abilities may again be due to the diversity of functions and may reflect differences in training and experience. Again, such correlation as results may be due to common features of the environment or it may be due to more or less general characteristics of the organism. For example, the following characteristics of the organism might be considered as general or as applying to the organism as a whole: size, total strength, quality of blood, general energy, quality of tissue, reactivity of the nervous system, or the number of neural elements. On the other hand, there may be organs or parts of the body which differ in quality from other parts as, for example, the sense organs, the muscles, the bones, the cavities of the mouth and nose, the

skin, the glands, and perhaps different parts of the nervous system. Thus, there may be organic features which produce correlation and others which are responsible for independence of traits.

Similarly, features of the environment may be general and bring about correlation, or they may be specific and bring about diversity. Examples of general features may be general amount of schooling and general effect of home environment or of environment of the immediate community. Specialization may be produced by special training or by accidental development of special interests.

It is common to find rather low correlations between many types of abilities. This might be explained either by the existence of special training or by the dependence of abilities upon relatively specific organs or parts of the body. The fact of correlation, therefore, does not in itself indicate whether abilities are functional or whether they have an organic basis.

The technique of factor analysis carries the study of the correlation between abilities a step further. It aims to uncover factors which do not appear in their true form but which lie hidden and combine with other factors to constitute abilities. The aim of factor analysis is to reduce the diversity of actual abilities to a few underlying elements.

Up to the present, factor analysis has not led to clear identification of the factors because different analyses which are mathematically consistent may be derived from the same correlations and these lead to the different conceptions of the constitution of abilities. Since the mathematical solutions are permissive rather than mandatory, the issue would seem to depend on psychological and biological considerations.

Taking these considerations into account, as well as the facts of correlation and the other facts which have been mentioned, we may draw the following tentative conclusions concerning the nature of abilities:

The abilities of individuals have a basis in organic structure but are not solely determined by such structure. The structure itself may be modified somewhat by environment, and the functioning of structures or organs may be modified still more. Abilities may be modified by education within limits.

The abilities of an individual vary among themselves. Some are highly specialized, others are more general. Both specialization and generalization may be brought about as effects of inherent structure and as effects of training. Some activities depend more on specialized abilities and some depend more on general abilities. The guidance of an individual should take account of both types of abilities.

What the most satisfactory analysis of abilities is is not yet certain, but it seems probable that the conception which best fits all the facts is one which includes abilities of a wide range of specificity or generality. Even after abilities are adequately analyzed and measured other factors in achievement must be recognized, such as are commonly called emotion, personality, and character.

Relationship Between a Measurement Program and a Guidance Program

GEORGE MELCHER, Superintendent of Schools,
Kansas City, Missouri

MUCH pedagogical literature seems to assume that guidance of youth is a new idea. Be assured that guidance is as old as the human race. Elders have always served as counselors and advisers for youth, but the importance of this guidance function has varied from generation to generation.

In a simple, primitive state of society guidance is an easy problem since there are only a few choices open to any youth. In a stable or static economic and social order it is possible to be quite definite in advice, but in an economic and social order that is exceedingly complex and rapidly changing, guidance becomes very difficult. In such a system few persons have the broad academic training, the industrial and economic experience, and the understanding of human nature necessary to perform the task of vocational guidance with the highest degree of success. We are in such society today. We are also very much lacking in the information needed for the wise direction of youth. We need to know more fully, both locally and nationally, the needs of the various professions, occupations, and jobs.

Early in the guidance movement some conceived the idea that, by knowledge of the I.Q.'s of individuals and certain other test scores, it might be possible to tell a boy or a girl the profession for which he should prepare. We have learned much. We now know that the normal youth has a wide range of possibilities. He may direct his capacities, talents, and interests to any one of many different types of work and succeed. In fact, the majority of normal youth can succeed in a large number of occupations or jobs that are open in the industrial and economic world.

The choice of a profession or occupation of a child must be a personal one. It is not possible for one individual to choose the life work for another. Today, with the wide variety of professions and occupations open to youth, it is important that adolescent youth have accessible information with regard to various types of work. They should know the educational requirements, the physical strength needed, and the opportunities and possibilities for promotion, advancement, and success in the various lines of work.

A study of successes and failures in various types of occupations reveals the fact that the majority of failures have not been due to lack of mentality or to lack of knowledge or skill in the work undertaken, but to lack of certain qualities of character that are essential in practically every type of work. If it were possible to make youth understand that there are certain qualities of character that are more fundamental

in success in any sort of endeavor or task, the guidance of youth would be made much easier. Every type of job demands honesty, dependability, industry, loyalty, and willingness to coöperate and to sacrifice for the good of the business.

A study of the work of the world indicates that less than 10 per cent of the people are in professions and managerial jobs such as law, medicine, dentistry, teaching, and executive and managerial positions in business. Approximately 20 per cent of all the people are engaged in semi-professional jobs. These include assistants to professional people, such as assistants in architects' and engineers' offices and all types of skilled work such as painters, carpenters, plumbers, acetylene welders, stenographers, bookkeepers, and office people. This leaves approximately 70 per cent of the population who are not in professions or in semi-skilled occupations. These, of course, include all farmers, workers in factories, mines, and mills, housekeepers, and all types of day laborers.

In handling a guidance program, this sort of picture must be before every counselor. In this country we are well prepared to take care of the 10 per cent who enter professions. In trade schools, business courses, and other types of semi-professional types of education, we are doing fairly well in providing for the 20 per cent. Our educational courses for the 70 per cent are quite inadequate. This is easily explained. A marvelous thing has happened in America. In the last thirty years the public high school has become the American common school. All classes and types of youth have entered the high school. Industries no longer want youth under eighteen or twenty years of age. The great mass of the youth enter a high school that is designed to prepare for the professions, only to find that the courses are not adapted to their needs. During the adolescent age of this 70 per cent we should have, in our high schools, courses that will equip them to live happier, more useful, and more successful lives. They should learn how to care for their own health and physical well-being. They should learn to use good English and to enjoy good literature. They should understand about human relationships; how to live in a coöperative, helpful manner with their fellow-men, and how to be good citizens in the community, in the state, and in the nation. They should learn enough of elementary science to understand themselves and the natural world about them. They should learn to appreciate the ethical and aesthetical values of life and should reach a level of social intelligence. This 70 per cent constitute the foundation of our democracy, and they should understand thoroughly the fundamental principles of democracy. In other words, high school courses need to be made more practical and functional for the lives of the majority of students.

We all know that much of the mathematics and many of the formulae in chemistry and physics as taught in the high school have little or no value to the average citizen. However, that average citizen should have a popular interest in these sciences that will help him to understand the world about him. He should have a course in biology that will prepare him for life and not for a medical school. He should have a course in world history that will lead him to enjoy and understand the progress of civilization and to appreciate the cultural heritage of

the present day and not a course that is designed to prepare him for an advanced course in history in college or university. That is, the courses in the social sciences and in the natural sciences must be made practical, functional courses. This must apply to all other high school courses, also.

But to come to our question, what connection does measurement in the public schools have to do with a guidance program? Dogmatically, I think we may say that measurement is at the basis of every sound guidance program.

We stated in the discussion this morning that we have in the Kansas City public schools the I.Q. of each child in the kindergarten and first four grades. In fact, many of the children are tested before they enter kindergarten. While our kindergarten age is five years, pupils of rather superior ability are admitted when they are four years, ten months of age. Children of inferior ability are advised to wait to enter kindergarten until they are five years, six months of age. Sometimes they wait until they are six years of age. Our kindergarten course is one year only. We have found that children are not ready for the first grade and do not master reading readily until they have a mental age of about five years, ten months. Therefore, a child who has an I.Q. of 85 or below would succeed better in school if he waited until he was six years old to enter kindergarten, and seven years for the first grade. The I.Q. becomes a most important factor in connection with a child's progress. A child with 90 I.Q. or above is expected to make normal progress through the grades. Pupils between 80 and 90 I.Q. can be expected to repeat a half-year once or twice in the elementary school. Knowing the I.Q. of pupils enables us to classify pupils in ability groups. This is begun in the first grade in our largest schools and carried on through the elementary grades and into the high school.

Finding that exceedingly low I.Q. pupils are not able to make progress in the regular grades, we have organized two types of classes other than the regular, normal grades.

First, we have opportunity schools to care for pupils whose I.Q.'s are between 50 and 70. Occasionally pupils who have I.Q.'s slightly above 70 and who do not make normal progress because of poor health or other deficiencies are placed in opportunity schools.

Second, in several of our schools we have organized classes known as limited or borderline classes for pupils having I.Q.'s from 70 to 80. Pupils with I.Q.'s of 80 to 85 who have difficulty in normal classes are placed in borderline rooms.

In our opportunity schools, one-third to one-half of the time is devoted to industrial and manual work. In the limited rooms, more attention is given to industrial work; also, the course of study is modified so that the pupils take only the minimum essentials of each grade. By limiting their work to the minimum essentials, most of these pupils are able to make a grade a year and graduate from the elementary school on schedule time.

Kansas City sends most of these pupils into trade schools. This, of course, is not in harmony with the plans of some school systems, since in some systems they do not admit pupils to trade schools with

I.Q.'s below 90. Our trade schools prepare pupils for the skilled and semi-skilled trades and not for the engineering profession.

In the elementary school, intelligence test scores and achievement test scores are used chiefly for classification in school and for educational guidance. By knowing the intelligence level and the academic abilities of the pupils, teachers are able to do two most valuable things for their pupils, especially for slow learners.

First, they can adjust the school tasks to the capacities of pupils. They do not demand or expect the impossible. The pupils are made happy and grow as rapidly as their abilities permit. They grow faster when given tasks within their abilities. They are inspired by success with their work and often make surprising progress. In the hands of a skillful teacher, these borderline pupils often master the minimum essentials of their grade as well or better than the normal pupils.

Second, they can arouse the interest of pupils in the type of life they must lead. In opportunity schools and borderline classes, the importance of the common tasks of the world is emphasized. Pupils are led to see that a good, courteous, dependable waitress is a valuable asset to a restaurant; a good janitor is very necessary in a store or a school. They are taught to respect the work of the janitor and the waitress. They learn that less education is needed for these jobs than for such professions as law, medicine, etc., and also that there are more such jobs available and greater chances of success.

The problem of guidance becomes very complex in the upper grades and in the junior high school. The teachers and counselors in these years have available for each pupil the following: (1) both the I.Q. and the group intelligence scores; (2) test results on standardized achievement tests; (3) teachers' marks on school subjects; (4) results of many physical examinations; (5) teachers' estimates of the pupil's ability to make normal, rapid, or slow progress in school; (6) teachers' judgments on the moral and social qualities of the pupil.

Pupils entering high school begin making important choices. Only 10 per cent can find places in the professions, about 20 per cent in the skilled trades and semi-skilled professional occupations. Two-thirds of the pupils want a course that will help them to live better, more happily, and more graciously as they perform the great mass of the world's work in the home, in the mines, in the factories, in the stores, in the offices, and in the common duties of life.

After the pupil enters high school he is confronted with a wide variety of subjects. Among the subjects are the following: (1) English; (2) social science; (3) algebra or applied mathematics; (4) general science; (5) fine arts; (6) physical education; (7) industrial arts and homemaking; (8) typewriting (for personal use only).

It is very difficult for pupils to make wise choices at this point, and it is difficult for teachers to guide them wisely.

In recent years we have been preparing, through our high school counselors in Kansas City, with the assistance of the faculties of the high schools, two types of material for the use of students and for the assistance of our teachers in the guidance of students:

First, a series of charts has been prepared on each subject taught in high school. As an appendix to this paper, two of these charts are submitted—one on chemistry and the other one on household arts or homemaking. These charts give an analysis of the general content of the subjects, followed by an analysis of the application of the subject to the work of the world. We feel that this is information that every teacher should have in order to advise her pupils wisely. It is also information which should be accessible to pupils.

Second, a series of bulletins was published on various professions and occupations. These bulletins give the pupil the information which he needs relative to the educational requirements, character requirements, special training needs, opportunities for advancement and promotion, and such other matters as are of interest to the party who is choosing the profession. These bulletins have been arranged in condensed form, just one mimeographed page for a profession or occupation. When a pupil becomes interested in any particular profession or occupation he is referred to the public library and to the school libraries. We are collecting in each high school library a large amount of material giving information on the various occupations so that the pupil who becomes interested in any particular occupation or group of occupations may have access to much literature in the profession or occupation in which he is interested.

In a flexible society we feel that the student should interest himself in a group of related occupations and then select the occupation to which he will give his major attention, but at the same time he should get a sort of general foundation that will enable him to shift from one particular occupation to another related occupation without serious loss.

As stated in the morning discussion, in the guidance of pupils in the high school in the choice of subjects and also in the choice of professions and occupations, the teacher or counselor makes much use of the intelligence test data and the achievement test data that are at hand. We know that certain professions and occupations require greater ability in abstract thinking than do other professions and occupations. We try as far as possible to counsel pupils so that they can make wise choices.

In all this work of guidance it must be understood that the final choice of a profession or occupation is the pupil's own choice. We are only aiding him in making that choice by giving him available information on the various professions and occupations in which he may be interested and by helping him to judge his own capacities, interests, and limitations. The final intelligence test of importance, the Ohio Psychological Examination, is given to the pupil in his senior year. At this point we are willing for him to have the results of this Ohio Examination, since they will help him in deciding whether he should or should not enter college. It will help him also in judging his capacities for different types of occupations. By this time he has become mature enough to use the results of this test in the proper way.

Unfortunately, in Kansas City we have no junior employment service; consequently, when the pupil has finished his training with us, he

must seek employment himself in industry or through the Federal Employment Service. Personally, I am of the opinion that every city should have a central employment service and should help all of the pupils who are out of school for any cause, or who graduate from school, to secure their first jobs.

Laboratory Technician [1]

The laboratory technician makes laboratory tests that are essential for the accurate diagnosis and effective treatment of many diseases.

Eligibility: Most training schools for laboratory technicians have the following minimum requirements:

1. The applicant must have completed a four-year course of an accredited high school.
2. The applicant must have completed two years of an accredited college or university. The college work must include organic and inorganic chemistry, biology, bacteriology, and physics. Elementary courses in these subjects should be elected in high school. Stenography and typewriting are also helpful.

Training: The course for the laboratory technician varies from twelve to fifteen months in length. It consists of lectures and textbook study with laboratory assignments and the performance of tests under supervision. After a period of instruction and laboratory practice, the students have direct contact with the patients for whom tests have been ordered. The course includes the making of blood counts, urinalysis, certain tests in body chemistry, tissue work, parasitology, blood tests, and bacteriological tests.

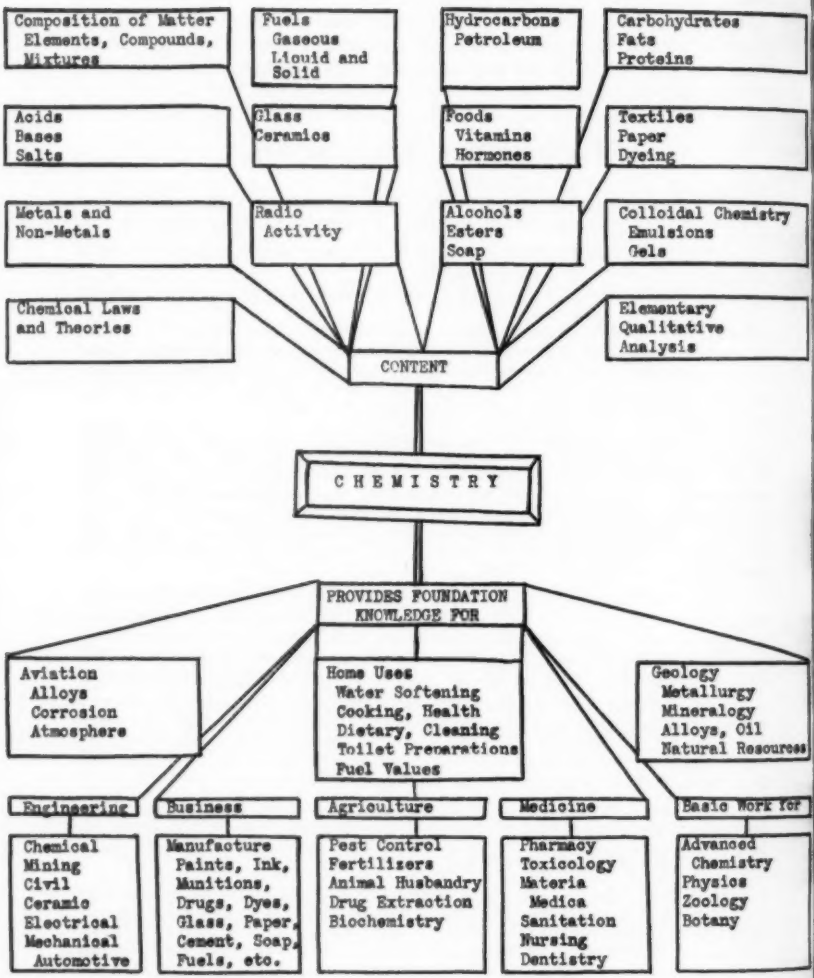
Qualifications: The applicant for training must fulfill the academic requirements cited above and must meet certain standards of appearance and personality. It is important that the individual be characterized by courtesy, neatness, and industry. Interest in science, accuracy in skill and in statement, and a desire for service are fundamental to success.

Training Schools: In Kansas City, training courses for laboratory technicians are maintained by the following hospitals: General, Menorah, St. Joseph's, St. Mary's, St. Luke's, and Research. Each school admits approximately six students annually. One or two applicants are accepted at a time, at two- or three-month intervals.

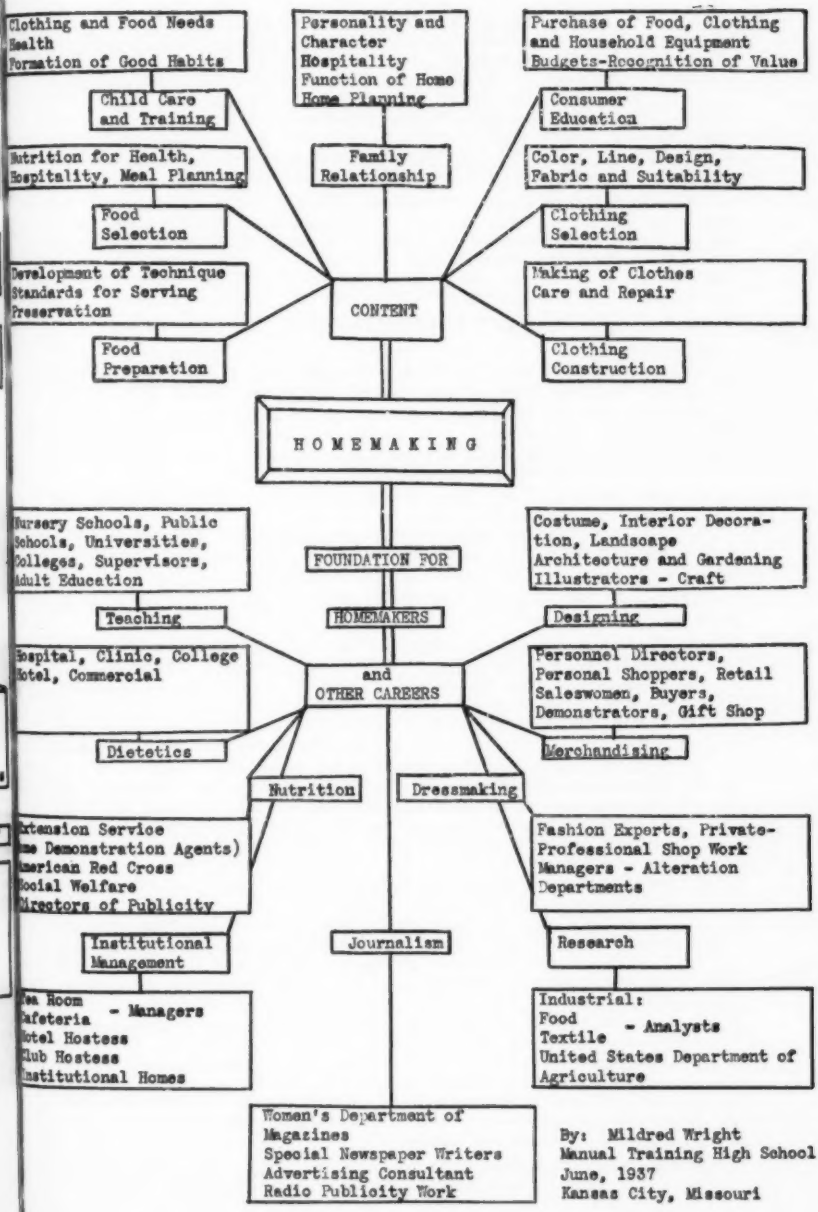
Expenses: No tuition is charged. Students must furnish their own uniforms. The laundering of the uniforms is cared for by the hospital. Most hospitals provide board only, although one or two offer both room and board for students in training.

Registry: The Registry for laboratory technicians is maintained by the American Society for Clinical Pathologists. On completing an accredited training course the student may apply to the registry for a certificate. Certificates are granted to applicants who have fulfilled the requirements for training and who pass the examinations conducted by the pathologists appointed by the Registry. These examinations are held twice per year. After securing a certificate, the laboratory technician may renew it annually for one dollar. The examination and original certificate fee is ten dollars. It is important to fulfill the requirements for a Registry certificate since the recognized medical, clinical, and hospital organizations accept the plan of the Registry to maintain standards of excellence and efficiency in the training schools and among practicing technicians.

[1] Guidance Bulletin 1—Department of High School Counseling, September, 1936.



Subject Guidance Chart
Kansas City, Missouri
September, 1937



By: Mildred Wright
Manual Training High School
June, 1937
Kansas City, Missouri

Opportunities: There is increasing recognition of the value of laboratory tests in medical service. Up to the present time, practically all graduates of the training schools in Kansas City have been placed in positions in hospitals, in other laboratories, or in the offices of physicians.

Salaries range from seventy-five dollars to one hundred twenty-five dollars per month. The hospital technician sometimes receives a somewhat smaller salary plus maintenance—room, board, and laundry. In larger laboratories requiring the services of several technicians, the technician in charge receives a somewhat larger salary than the average.

Further Information: Pamphlets stating the requirements for elegibility and service may be secured through the counselor or by writing to: Registry of Technicians, American Society of Clinical Pathology, 224 Metropolitan Building, Denver, Colorado.

Air Conditioning [2]

Air conditioning includes the heating and cooling of rooms through the control of temperature, humidity, air cleansing, and air distribution.

Fields of Work: There are four fields of work in air conditioning which are open to engineers or to mechanics: designing, manufacturing, selling, and installation with service. The activities of these phases of work are directed toward two objectives:

1. The making of atmospheric conditions that are comfortable and healthful for the occupants of the rooms.
2. The maintaining of conditions that are most favorable to the manufacturing of commodities that are affected by atmospheric conditions.

Training: The four general fields of work in air conditioning require specific training:

1. Designing for the manufacturer or the distributor requires high school graduation and the university curriculum of Mechanical Engineering. The high school course should include mathematics, physics, chemistry, and shop work. The engineering course should include refrigeration, ventilation, and some electrical work in addition to the mechanical engineering. There must be aptitude for experimental and laboratory work also.
2. Manufacturing requires the high school course as outlined above and practical experience through employment with an air conditioning equipment manufacturer. Technical training in engineering is essential, also, if one wishes to become a research or layout engineer.
3. Selling requires the highest technical training in engineering if it includes the determining of the most efficient system for the job and the estimating of installation cost. The selling of room units for distributors requires high school training with courses in salesmanship, drafting, and public speaking. A period of employment with a manufacturer of equipment affords a valuable background.
4. Installation-Service requires mechanics skilled in steamfitting, sheet metal work, and electrical work. The best preparation for these fields of work is to be obtained in a trade school. Practical experience gained through a period of employment with a manufacturer and in trade school evening courses in refrigeration, ventilation, and air conditioning should supplement trade school training.

[2] Guidance Bulletin 2—Department of High School Counseling, October, 1936.

Opportunities: These are increasing in all phases of air conditioning with the recognition of the importance and comfort of air conditioning for summer as well as winter. Salaries vary with the field of work and with the experience of the employee:

1. Designing and manufacturing: Graduate engineers often begin as draftsmen at approximately seventy-five to one hundred twenty-five dollars per month for making drawings and doing layout work. The engineer may expect to advance gradually to approximately two hundred fifty dollars per month if he succeeds in improving designs or becomes a layout or estimating engineer.
2. Installation and service: The trained mechanic receives from one hundred twenty-five to one hundred seventy-five dollars per month. Opportunities are increasing and the work is not seasonal. Plumbing and heating contractors who install and service many large air conditioning systems are demanding an increasing number of mechanics with trade school training.
3. Selling: The engineer who estimates and sells central systems or units is paid approximately one hundred fifty to two hundred fifty dollars per month. A successful retail salesman for a distributor of room units earns approximately two hundred dollars per month.

Further Information: Pamphlets on air conditioning may be obtained from the counselor.

Interior Decoration [3]

Interior decoration is the vocation devoted to making the interior of homes and other buildings more beautiful and more suitable. The work often includes designing part of the materials to be used.

Fields of Service: The fields of interior decoration are varied, including the interior decoration not only of homes, but of business and public buildings, of hotels, clubs, apartment houses, theaters, and of ocean liners. The work of the interior decorator is often very closely related to that of the architect and builder, and with that of the dealers in furniture, rugs, and art objects.

Qualifications: The interior decorator must possess good taste, refinement, tact, and a combination of idealism and practical sense. Knowledge and appreciation of color harmony and of symmetry of line and form are essential. Originality and initiative are important. The cultural background to be obtained through schools, travel, and reading is fundamental to success. Ability to do rapid sketching and careful detail drawing is necessary. An understanding of good salesmanship is also very helpful.

Education and Training: A high school course with emphasis on English, history, art, and homemaking is essential before specific training in this field. Schools of art usually offer two- and three-year courses in interior decoration. These courses include methods of interviewing, making estimates, and other business essentials as well as training in the skills, history, and principles of decoration. High school graduation, a broad liberal arts curriculum with special courses in fine arts and architecture, extensive reading in history and the arts are recommended as minimum training. Most schools require careful study of the history of England and of France. The formal training is made more valuable if vacation periods are spent in employment in the home furnishing departments of stores or in other firms that handle the materials used in interior decoration. The obtaining of contracts and carrying the work to

[3] Guidance Bulletin 16—Department of High School Counseling, February, 1938.

completion involves many detailed services by numerous workmen. While the interior decorator does not need to be skilled in these related occupations, he must understand them in order to direct their use in securing the desired results.

Opportunities: Opportunities for interior decorators are increasing because of a greater appreciation of beautiful and artistic furnishings in homes and business buildings. There is a tendency in the United States to make more money available for the decorating and furnishing of public and private buildings. For experienced decorators there are some positions as consulting decorators of staffs of large hotel companies. Some firms of architects have established interior decorating departments. The field is open to women as well as men. The greatest opportunity at present is in the privately owned shops. In Kansas City a number of the larger department stores and furniture stores have excellent interior decorating departments. Besides these firms there are several exclusive interior decorating studios.

Remuneration: Beginners in interior decoration may secure positions in decorating departments in large department stores or other decorating establishments at salaries from twenty to thirty-five dollars per week. Further experience will qualify for positions paying fifty dollars and more per week. Experienced decorators often open their own shops. Incomes depend on personality, reputation, and the clientele that can be established. Women have been approximately as successful financially as men. It is estimated that the experienced woman receives more than the average for other professions open to women; men slightly less.

Schools: The Kansas City Art Institute offers courses in interior decorating. The Parson's School of Applied Art, New York and Paris; the Art Institute of Chicago; the School of Fine and Applied Arts of Pratt Institute, Brooklyn, New York; the National Academy of Art, Chicago, and a number of universities and other art schools have departments of training. A more complete list may be obtained through the counselor.

Further Information: Detailed information may be found in Careers Bulletin. Copies are available in the library and in the counselor's office.

Intellectual Growth Based on Longitudinal Studies

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PROBLEMS which we wish to solve in the study of intellectual growth include the rate of growth at successive ages, the age at which maturity is reached or mental growth ceases, and the relation of the growth of children of different degrees of ability in respect to rate of growth and age of maturity in intellectual growth.

These problems have usually been attacked by the cross-section method, which consists in testing different children at different ages and then constructing growth curves from the average of these different groups. This method suffers from two serious defects: In the first place, it does not give a picture of the growth of any individual child, and, in the second place, it is likely to be seriously affected by an unrepresentative sampling of children at some of the ages.

Both of these defects are overcome by testing the same children at successive ages through as long a period of years as possible. This method was used in a ten-year study in the Laboratory Schools of the University of Chicago. A group of four tests was used which, taken together, constitute a reasonably good intelligence test. The individual children were followed through different periods of time depending on the length of time they remained accessible to the study. Large enough numbers were followed through six years or more to give fairly long curves of growth.

The curves of individual children show clearly that not all children grow at the same pace. Furthermore, the ages at which growth is slower or more rapid differ in different children. It is a serious error to assume that the average curve for children in general will represent the mental growth of each child. Some have alternating periods of rapid and slow growth, some grow rapidly in the earlier years and slower later on, others grow more slowly in the earlier years and then have a period of rapid growth in the later years. Not many children differ greatly from these curves of growth, but enough do so differ as to make it hazardous to predict the growth of a particular child by comparing him with the average. It is particularly dangerous to assume, as is often done, that because a child is advancing slowly in the early part of his school career he will necessarily advance as slowly in the later part.

Continuous records are particularly valuable to enable us to tell how long mental growth continues. Soon after the war it was reported that an army test showed that the average adult has a mental age of only about thirteen years. This would indicate that intellectual growth does not continue all this time. Some psychologists argue that actual brain power does not increase and that any improvement that occurs

after this age is due entirely to education. There is no way, however, of separating the effect of education and of maturity of the nervous system. What we actually find is that when we measure the same persons year after year they continue to gain even into college. Furthermore, the gain is almost at the same rate in the later years of adolescence as it is in the earlier years. In general, the rate of growth from eight or nine years of age to twenty years of age declines gradually, but it is still about half as rapid from eighteen to twenty as it is from eight to ten.

The figures from longitudinal study also contradict the common view concerning the growth of bright and dull children. Our findings show that the brightest group gains a little more rapidly in early adolescence than the average or duller children, but this greater rapidity does not continue throughout the adolescent period. After fourteen or fifteen years of age the groups of different ability levels gain at about the same rate. This means that children of lower ability keep pace in their mental growth with the brighter ones. The common view is that they gain more slowly and that they cease growth earlier. On the contrary, they gain at about the same rate and continue their growth as long as, if not longer than, the brighter children. This indicates a more favorable prediction of the ultimate intellectual status of the duller children than is indicated by the traditional view.

A List of Bulletins in the Field of Education, Indiana University

The following is a list of the bulletins published by the School of Education, Indiana University.

All bulletins which are available at the present time may be secured for fifty cents ($.50) per copy, with the exception of the *Second Revision of the Bibliography of Educational Measurements;* the *Bibliography of School Buildings, Grounds and Equipment—Part I; The Philosophy of Human Relations—Individual and Collective;* the *Bibliography of School Surveys and of References on School Surveys;* and the *Bibliography of College and University Buildings, Grounds, and Equipment,* which may be secured for seventy-five cents ($.75) per copy and may be obtained from the University Bookstore.

Proceedings of the High School Principals' Conference (November 23 and 24, 1923). Vol. I, No. 1, 1924. 85 p. (Supply exhausted.)

Investigation of Nursing as a Professional Opportunity for Girls. Part I, Technical Study; Part II, Vocational Information Bulletin. By Florence E. Blazier. Vol. I, No. 2, 1924. 69 p.

Proceedings of the Eleventh Conference on Educational Measurements. Vol. I, No. 3, 1925. 141 p.

Proceedings of the High School Principals' Conference (November 14 and 15, 1924). Vol. I, No. 4, 1925. 49 p. (Supply exhausted.)

First Revision of the Bibliography of Educational Measurements. Compiled by the Bureau of Coöperative Research. Vol. I, No. 5, 1925. 147 p. (Supply exhausted.)

Proceedings of the Twelfth Conference on Educational Measurements. Vol. I, No. 6, 1925. 76 p.

The Effect of Population upon Ability to Support Education. By Harold F. Clark. Vol. II, No. 1, 1925. 28 p.

Proceedings of the High School Principals' Conference (November 20 and 21, 1925). Vol. II, No. 2, 1925. 77 p. (Supply exhausted.)

A Cross-Indexed Bibliography on School Budgets. By Harold F. Clark. Vol. II, No. 3, 1926. 66 p.

A Comparison of the Results Made on Certain Standardized Tests by Pupils in the Bloomington High School Who Were Taught in Classes of the Same Grade by University Student Teachers and by Regular High School Teachers. By Carl G. F. Franzén. Vol. II, No. 4, 1926. 19 p.

Proceedings of the Thirteenth Annual Conference on Educational Measurements. Vol. II, No. 5, 1926. 103 p.

When to Issue School Bonds. By Harold Florian Clark and Paul Royalty. Vol. II, No. 6, 1926. 16 p.

Students' Attitude Toward Examinations. By Grover T. Somers. Vol. III, No. 1, 1926. 48 p.

Proceedings of the High School Principals' Conference (November 12 and 13, 1926). Vol. III, No. 2, 1926. 27 p.

Index Numbers in School Administration. By Harold F. Clark. Vol. III, No. 3, 1927. 35 p.

Topical Analysis of 234 School Surveys. Compiled by the Bureau of Coöperative Research. Vol. III, No. 4, 1927. 111 p. (Supply exhausted.)

Proceedings of the Fourth Annual Conference on Elementary Supervision. Vol. III, No. 5, 1927. 64 p.

Proceedings of the Fourteenth Annual Conference on Educational Measurements. Vol. III, No. 6, 1927. 66 p.

Some Phases of the Junior College Movement. By I. Owen Foster, Harold F. Clark, Willard W. Patty, and Leo M. Chamberlain. Vol. IV, No. 1, 1927. 125 p. (Supply exhausted.)

Second Revision of the Bibliography of Educational Measurements. By Henry Lester Smith and Wendell William Wright. Vol. IV, No. 2, 1927. 251 p.

Bibliography of School Buildings, Grounds, and Equipment, Part I. By Henry Lester Smith and Leo Martin Chamberlain. Vol. IV, No. 3, 1928. 326 p.

Proceedings of the High School Principals' Conference (November 18 and 19, 1927). Vol. IV, No. 4, 1928. 54 p.

The Economic Effects of Education. By Harold F. Clark. Vol. IV, No. 5, 1928. 39 p.

Proceedings of the Fifteenth Annual Conference on Educational Measurements. Vol. IV, No. 6, 1928. 73 p.

Proceedings of the Fifth Annual Conference on Elementary Supervision. Vol. V, No. 1, 1928. 54 p.

Proceedings of the High School Principals' Conference (November 16 and 17, 1928). Vol. V, No. 2, 1928. 33 p.

The Development and Use of a Composite Achievement Test. By Wendell William Wright. Vol. V, No. 3, 1929. 90 p.

An Analysis of the Attitudes of American Educators and Others Toward a Program of Education for World Friendship and Understanding. By Henry Lester Smith and Leo Martin Chamberlain. Vol. V, No. 4, 1929. 109 p.

Tentative Program for Teaching World Friendship and Understanding in Teacher Training Institutions and in Public Schools for Children Who Range from Six to Fourteen Years of Age. By Henry Lester Smith and Sherman Gideon Crayton. Vol. V, No. 5, 1929. 54 p.

Proceedings of the Sixteenth Annual Conference on Educational Measurements. Vol. V, No. 6, 1929. 96 p.

Proceedings of the Sixth Annual Conference on Elementary Supervision. Vol. VI, No. 1, 1929. 73 p.

An Analysis of the Duties of County School Superintendents and Superintendents of Schools in Certain Cities in Indiana. By Henry Lester Smith and Leo Martin Chamberlain. Vol. VI, No. 2, 1929. 94 p.

Proceedings of the High School Principals' Conference (November 22 and 23, 1929). Vol. VI, No. 3, 1930. 51 p.

Coöperative Studies in Secondary Education. By Henry Lester Smith and Carl G. F. Franzén. Vol. VI, No. 4, 1930. 121 p.

Proceedings of the Seventeenth Annual Conference on Educational Measurements. Vol. VI, No. 5, 1930. 103 p.

Proceedings of the Seventh Annual Conference on Elementary Supervision. Vol. VI, No. 6, 1930. 102 p.

A Study in Teacher Supply and Demand in Indiana. By I. Owen Foster, Robert K. Devricks, Harry N. Fitch, Earl C. Bowman, and George L. Roberts. Vol. VII, No. 1, 1930. 77 p.

Proceedings of the High School Principals' Conference (November 7 and 8, 1930). Vol. VII, No. 2, 1930. 70 p.

The Philosophy of Human Relations: Individual and Collective—A Source Book. By Henry Lester Smith and Harold Littell. Vol. VII, No. 3, 1931. 326 p.

The Psychology of Human Relationships: Individual and Social—A Source Book. By Henry Lester Smith and Levi McKinley Krueger. Vol. VII, No. 4, 1931. 107 p.

Proceedings of the Eighteenth Annual Conference on Educational Measurements. Vol. VII, No. 5, 1931. 83 p.

Efficiency in College Management. By John Dale Russell. Vol. VII, No. 6, 1931. 143 p.

Bibliography of School Surveys and of References on School Surveys. By Henry Lester Smith and Edgar Alvin O'Dell. Vol. VIII, Nos. 1 and 2, 1931. 212 p.

Proceedings of the Nineteenth Annual Conference on Educational Measurements. Vol. IX, No. 1, 1932. 139 p.

Bibliography of School Buildings, Grounds, and Equipment—Part II. By Henry Lester Smith and Forest Ruby Noffsinger. Vol. IX, No. 2, 1933. 182 p.

Bibliography of School Buildings, Grounds, and Equipment—Part III. By Henry Lester Smith and Forest Ruby Noffsinger. Vol. IX, No. 3, 1933. 130 p.

A Brief Summary of Literature on Leadership. By Henry Lester Smith and Levi McKinley Krueger. Vol. IX, No. 4, 1933. 80 p.

Proceedings of the Twentieth Annual Conference on Educational Measurements. Vol. X, No. 1, 1933. 98 p.

Bibliography of College and University Buildings, Grounds, and Equipment. By Henry Lester Smith and Forest Ruby Noffsinger. Vol. X, No. 2, 1934. 199 p.

Factors Affecting the Organization of School Attendance Units. By Raleigh Warren Holmstedt. Vol. X, No. 3, 1934. 32 p.

The Old World Historical Background of Religious and Moral Education in Schools. By Henry Lester Smith, Robert Stewart McElhinney, and George Renwick Steele. Vol. X, No. 4, 1934. 144 p.

Proceedings of the Twenty-first Annual Conference on Educational Measurements. Vol. XI, No. 1, 1934. 96 p.

Bibliography of School Buildings, Grounds, and Equipment—Part IV. By Henry Lester Smith and Forest Ruby Noffsinger. Vol. XI, No. 2, 1935. 216 p.

A Brief Survey of Present-Day Religious and Moral Education in the Schools of Countries Other Than the United States of America. By Henry Lester Smith, Robert Stewart McElhinney, and George Renwick Steele. Vol. XI, No. 3, 1935. 185 p.

Some Practical Efforts to Teach Good Will. By Henry Lester Smith and Peyton Henry Canary. Vol. XI, No. 4, 1935. 169 p.

Proceedings of the Twenty-second Annual Conference on Educational Measurements. Vol. XII, No. 1, 1935. 97 p.

A Basis for the Improvement of Education in Rural Monroe County, Indiana. By Henry Lester Smith and Forest Ruby Noffsinger. Vol. XII, No. 2, 1936. 168 p.

Reading Readiness—A Prognostic Study. By Wendell William Wright. Vol. XII, No. 3, 1936. 46 p.

Proceedings of the Twenty-third Annual Conference on Educational Measurements. Vol. XII, No. 4, 1936. 60 p.

Bibliography of Literature on the Teaching of English. By Henry Lester Smith and William Isaac Painter. Vol. XIII, No. 1, 1936. 299 p.

Bibliography of Literature on Education in Countries Other Than the United States of America. By Henry Lester Smith and William Isaac Painter. Vol. XIII, No. 2, 1937. 341 p.

Character Development through Religious and Moral Education in the Public Schools of the United States. By Henry Lester Smith, Robert Stewart McElhinney, and George Renwick Steele. Vol. XIII, No. 3, 1937. 137 p.

Proceedings of the Twenty-fourth Annual Conference on Educational Measurements. Vol. XIII, No. 4, 1937. 100 p.

Bibliography of Literature on Education in Countries Other Than the United States of America (January 1, 1919, to December 31, 1924). By Henry Lester Smith and William Isaac Painter. Vol. XIV, No. 1, 1937. 139 p.

Two Studies in Education. By Henry Lester Smith and Merrill Thomas Eaton. Vol. XIV, No. 2, 1938. 42 p.

Bibliography of School Surveys and of References on School Surveys (Supplement to Vol. VIII, Nos. 1 and 2). By Henry Lester Smith and Edgar Alvin O'Dell. Vol. XIV, No. 3, 1938. 144 p.